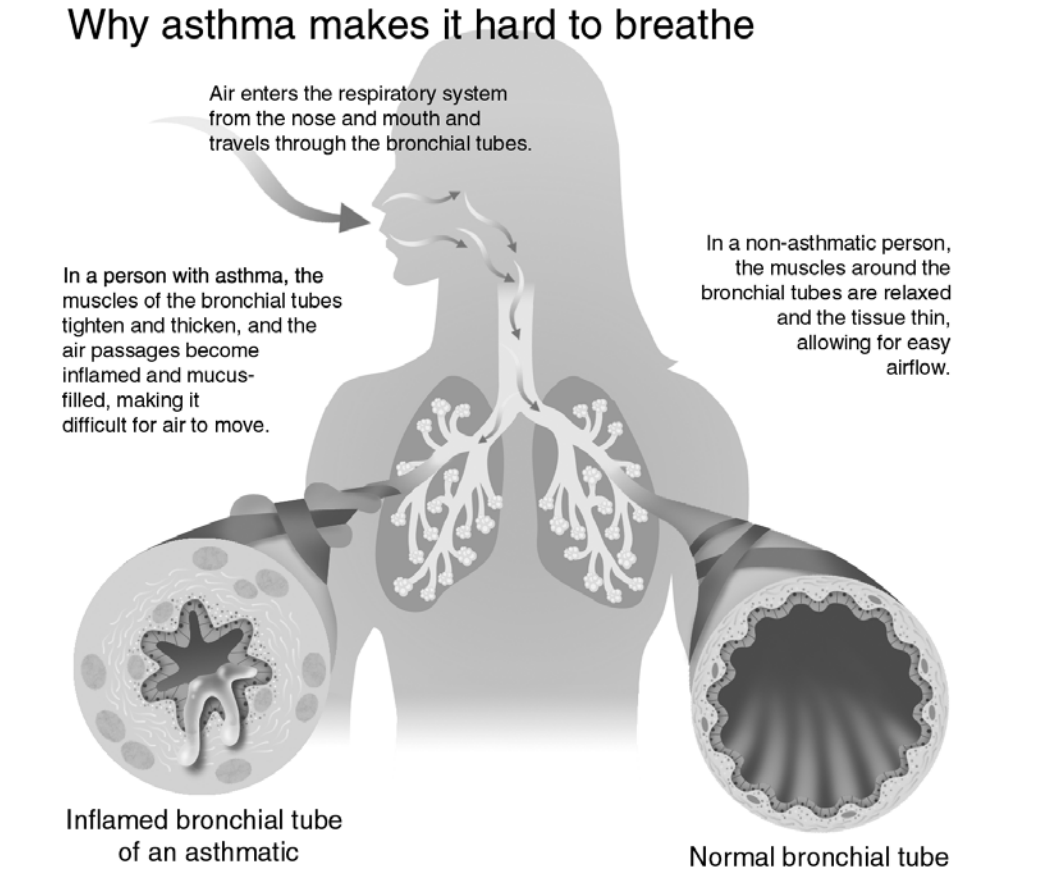
What is Asthma?

Asthma is a chronic inflammatory disorder of the airways. It is defined by the American Thoracic Society as a disorder with the following characteristics, not all of which need be present to assign the diagnosis of asthma

- Airway Obstruction - A blockage of an airway that is generally reversible either on its own or with treatment
- Airway Inflammation - Swelling of the airways which can reduce the amount of air flowing to and from the lungs
- Airway Hyper-responsitivity – An exaggerated narrowing of the airways which limits airflow in response to a wide variety of stimuli, including allergens/asthmagens, environmental irritants, viral infection, or exercise[1]



Asthma can range from being an intermittent nuisance triggered by specific factors, such as allergen exposure or exercise, to being a severe, progressive, and occasionally fatal disease without apparent external cause. This diversity has led to a growing appreciation that asthma, as currently defined, probably is not a specific disease, but a syndrome with multiple causes leading to reversible airway obstruction.

1 Centers for Disease Control. (2004). Pathophysiology. In *National Asthma Training Curriculum* [CD-ROM]. Centers for Disease Control.

2 *American Academy of Allergy, Asthma & Immunology Website.* Retrieved August 4, 2005. http://www.aaaai.org/media/photographics/illustrations.stm

Exacerbating Factors

Allergens, irritants or other triggers that can cause asthma symptoms to worsen.

Allergens

Substances that can cause an allergic reaction, usually absorbed through the skin, nasal passages, lungs or digestive tract.

Irritants

Substances that can cause irritation of the skin, eyes, or respiratory system. Effects may be acute from a single high level exposure, or chronic from repeated low-level exposures.

Triggers

A factor that may bring on or increase the signs and symptoms of asthma.

Untreated or Under-treated Asthma

Untreated or under-treated asthma can be damaging for the person with asthma. Not only can it lead to activity limitation or death, it can lead to airway remodeling. Airway remodeling consists of structural changes that are unlikely to be reversible, resulting from the continued inflammation seen in chronic asthma.

How and Why People Develop Asthma

The cause of asthma is unknown, but it is apparently due to an interaction between genetic and environmental factors. This is the subject of intense current research. The observation that asthma is more prevalent in industrialized countries than in underdeveloped ones has spurred divergent theories. Some people hypothesize that too much modern-day cleanliness encourages inflammatory pathways that lead to asthma as children fail to develop normal immune responses.[3] This theory has been termed the "hygiene hypothesis." Others point to increasing disease in modern society, caused by burning fuels and other pollutants, as well as homes with poor air circulation, indoor pets, and carpeting. Both arguments have merit.

Asthma over the Lifespan

Asthma is often first diagnosed in childhood. Between 50% and 90% of children with asthma develop symptoms (coughing, wheezing, shortness of breath or rapid breathing, and chest tightness) before five years of age.[1] It is sometimes labeled in infants and young children as Reactive Airway Disease. If symptoms persist over the next few years, an asthma diagnosis may follow.

Asthma can develop at any age. When asthma presents in adulthood, it may be a recurrence of recognized or unrecognized childhood asthma that had gone into clinical remission (typically in the early adolescent years). Asthma in persons over the age of 20 appears to be more common and more severe in women. An estimated 15% of adult asthma can be attributed to workplace exposures.[1]

Asthma and Other Chronic Diseases

Asthma is strongly associated with other types of chronic disease. Recently, several studies have reported a correlation between obesity (higher body mass index) and a greater risk of developing asthma in both children and adults. In addition, there is some evidence that weight loss improves lung function, symptoms, morbidity, and health status in obese persons with asthma.[4]

People with asthma may require treatment not only for asthma, but also for associated conditions. For example, people who have been hospitalized for asthma also have an increased risk of subsequent death from chronic obstructive pulmonary disease (COPD) and cardiovascular disease. Research also suggests that these people require as much attention for their other chronic diseases as their asthma.[5]

New-onset asthma in adults with airway obstruction and a history of smoking must be differentiated from chronic obstructive pulmonary disease (COPD). COPD that includes emphysema and chronic bronchitis is airway obstruction due to lung damage primarily associated with smoking. Asthma in adults aged 65 years and older is generally more severe than in younger adults with asthma, based on symptom frequency and severity, medication requirements, hospitalization rates, and mortality rates.

Asthma Triggers in the Environment

The actual cause of the underlying airway inflammation in persons with asthma is often not fully known, although allergens and viral infection may be important in this regard. Once a person has inflamed airways and asthma, multiple factors (triggers) may precipitate or increase asthma symptoms.

1 Centers for Disease Control. (2004). Pathophysiology. In *National Asthma Training Curriculum* [CD-ROM]. Centers for Disease Control.

3 Centers for Disease Control. (2004). Pathophysiology. In *National Asthma Training Curriculum* [CD-ROM]. Centers for Disease Control.

4 Dilley, J., Pizacani, B., Macdonald, S., & Bardin, J. (2005). *The Burden of Asthma in Washington State*. Olympia, WA: Washington State Department of Health.pg:58

5 National Institutes of Health. *National Heart, Lung and Blood Institute*. (1996) NAEPP Working Group *Report: Considerations for Diagnosing and Managing Asthma in the Elderly*. Pg 5

Table 1: Examples of Indoor and Outdoor Asthma Triggers

Agent	Major Sources
Indoor Agents	
Dust mites	Mattresses, bed linens, stuffed fabric toys, feather pillows, carpeting
Animal allergens (dander, saliva, urine)	Cats, dogs, rodents, birds
Cockroaches	Moisture and availability of organic food sources.
Secondhand Smoke	Cigarettes, cigars, other tobacco products
Molds	Excess moisture due to plumbing leaks, roof, walls, window leaks, floods, lack of foundation drainage resulting in damp basements, lack of ventilation
Nitrogen Oxides	Room-vented gas or oil-fired space heaters, gas-fueled cooking stoves and cook tops
Odors Volatile organic compounds	Sprays, deodorizers, pesticides, mold, solvents Pesticides, sealants, adhesives, insulation materials, combustion product, molds
Ozone (O_3)	Laminators and copiers, printers, some air cleaners
Outdoor Irritants	
Ozone (O_3)	Hydrocarbon vapors and nitrogen oxides from combustion (motor vehicles, boats, lawnmowers, power plants) that react in sunlight
Sulfur dioxide (SO_2)	Fossil fuels (power plants), industrial sources; sulfur-containing motor fuels
Fine particulate	Diesel exhaust, gasoline engine exhaust, wood stove and fireplace burning and agricultural burning

Adapted from: Etzel, R. Balk, S., (Eds).(1999). *Handbook of Pediatric Environmental Health*. 1st ed., American Academy of Pediatrics.

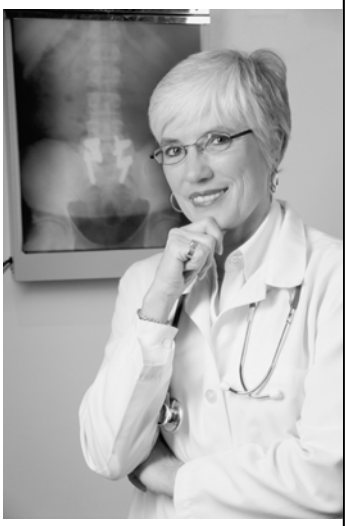
In addition, a number of exposures at work can trigger asthma (see the *Work-Related Asthma* chapter). Some cases of work-related asthma may occur because of a single, high-dose exposure (e.g., ammonia, chlorine gas). Other examples of work-related asthma are associated with longer-term, more continuous exposures (e.g., cedar tree dust).

Exercise as an Asthma Trigger

Asthma can also be triggered by exercise. This condition, called exercise-induced bronchospasm or exercise-induced asthma (EIA), involves narrowing of the airways leading to the lung. It is caused by the loss of heat, water, or both from the airways during exercise that occurs with increased ventilation and inhalation of cool, dry air compared to the air within the lungs.[1] When healthy people exercise, they experience panting and feel out of breath; once exercising has stopped their breathing shortly returns to normal. Persons with EIA experience increased breathlessness once they have stopped exercising, which may not improve until at least 10 minutes after exercising.[1] Parents, teachers, child care providers and others who encourage and monitor exercise in children should be aware of the child's asthma

management/action plan's recommendations on exercise so that they may provide appropriate exercise programs for children with asthma.

Diagnosing Asthma



The diagnosis of asthma is based on the patient's history, physical examination, and objective tests. The history identifies characteristic symptoms as well as a pertinent family history. The history also identifies triggering factors important for that patient. Finally, the history defines the effects of the disease on the patient—unscheduled hospital or clinical care, missed school or work, activity limitations, psychosocial issues, and financial burden.

There are five key indicators for asthma diagnosis that have been identified by the National Asthma Education and Prevention Program (NAEPP) expert panel; however they are not, by themselves, a diagnosis. If multiple indicators are present then it increases the probability that asthma is present. These include:

- History of cough (especially at night), recurrent wheeze, recurrent shortness of breath, difficult, labored breathing, or recurrent chest tightness
- Wheezing, especially in children
- Reversible airflow limitation, happening at varied times during the day, that can be measured by using a peak flow meter
- Symptoms that occur or worsen in the presence of exercise, viral infection, animals with fur or feathers, house-dust mites, mold, smoke, pollen, changes in weather, strong emotional expression, airborne chemicals/dusts, and/or menses
- Symptoms that occur or worsen at night, awakening the person with asthma

Asthma severity can range from mild to severe. Medications) to control asthma are typically prescribed by health care providers based on severity (called classification. Persons with asthma may fluctuate between severity classifications based on exposure to asthma triggers or colds. Patients may move between classifications on a daily basis. For more information on asthma diagnosis, refer to the *Health Care* chapter.

Diagnosis of Work-related Asthma

The diagnosis of work-related asthma should be suspected in all adults with new-onset asthma or recent clinical deterioration. The first step to an appropriate diagnosis is a complete medical history and physical exam. The medical history should include a complete environmental and occupational exposure history. If the exam and history are suggestive of work-related asthma, then the use of objective testing to both diagnose the asthma and attribute it to the workplace should be conducted.

An appropriate and timely diagnosis is critical, as delayed diagnosis and management can often lead to poorer health outcomes. Further, inappropriate diagnosis or management can result in adverse socioeconomic impacts on workers and employers through the loss of productive work. As the diagnosis of work-related asthma is difficult, referral to a specialist is often appropriate and may help to facilitate potentially complex medical, legal, or compensation issues. For information on work-related asthma including known asthmagens in the workplace see the *Work-Related Asthma* Chapter.

The Relationship between Allergies and Asthma

There is a relationship between allergies and asthma; between 70% and 90% of children with asthma have positive allergy skin tests.1 Positive allergy skin tests may or may not correlate with clinical problems.

Determining the relationship between positive allergy skin tests and clinical problems requires family input and evaluation by a health care professional, preferably an allergy specialist. A majority of children with asthma have positive skin test reactions to inhalant allergens such as house-dust mites, cockroaches, animal dander, mold, and pollen. Exposures to these allergens often correlate with increased airway irritability and asthma. This correlation does not hold true for food allergens. While some children with asthma may have food allergy, food does not often trigger asthma unless it is part of a generalized anaphylactic reaction.

In adults with asthma, the prevalence of positive allergy skin tests decreases somewhat with age. However, a recent study has shown that nearly 75% of persons with asthma over age 65 years still had at least one positive allergy skin test. This finding supports the association of asthma with atopy, a tendency to make allergic antibodies after exposure to common environmental agents.[1]

Patients with persistent asthma who are exposed to perennial indoor allergens should be tested for sensitivity to these allergens. Allergy testing can help diagnose allergic factors that contribute to asthma severity and identify approaches and possible candidates for allergy shots (immunotherapy). Testing for indoor molds is problematic because tests are often are limited to those commonly found outdoors and do not contain antigens for common indoor molds. Not all allergy testing has to be conducted by an allergist to interpret and act on skin tests. Also, not all patients may have access to an allergist.

Persons with asthma that is well controlled can lead happy healthy lives. However when a person's asthma is undiagnosed, untreated, undertreated or they live in an unhealthy environment their asthma may interfere with their activities of daily life. The Washington State Asthma Plan has been developed to address prevention, diagnosis and management of asthma in Washington State.

1 Centers for Disease Control. (2004). Pathophysiology. In *National Asthma Training Curriculum* [CD-ROM]. Centers for Disease Control.